KNOWLEDGE OF COUNCIL'S METERING INSTALLATION PRACTICES & PROCEDURES

1. Is it always necessary to install bottom connected energy meters which are rated at 100A (i.e. 15/100), alternatively, what guidelines should be adhered to when requesting meters?

   Ans. No. Where supplies of 15/100 meters are not readily available, meters with a rating of not less than the load should be installed for fixed loads such as water heaters and the like.

2. Is there any requirement of the Council to protect meters against short circuit, if so, how is this achieved (Service Rule 4.1.2)?

   Ans. Yes. Where the size of the service exceeds 100A, the customer shall arrange the installation so that all direct connected meters and associated control devices and wiring connected to them, is on the load side of H.R.C. fuses or an approved over current circuit breaker.

3.(a) Are there any requirements necessary to avoid the adverse effects of external magnetic fields on meter accuracy?

   Ans. The customer is to provide and maintain adequate spacings between meters and current carrying conductors - also, could provide shielding of meter installation.

3.(b) Where are these details provided?

   Ans. Spacing in accordance with Publication E.I.8 - Provision of Service Equipment in Multiple Installations.

4. What are the conditions applicable before summation metering will be provided?

   Ans.
   (a) Eligible to receive Demand tariff.
   (b) Supplied through the same service or within the same building.
   (c) Customer to provide wiring of suitable size and type and installed in a manner approved by the Council.
   (d) If more than one service is provided, both must originate from the same substation or terminate at the same switchboard.

5. What are two acceptable methods of providing summated accounts?

   Ans. (a) Arithmetical; (b) Impulse; (c) Thermal Converters; (d) Electrical summation of C.T.secondaries.

6. What is the maximum size of conductor that may be connected to the terminals of a plug-in meter socket base?

   Ans. $25mm^2$.

7. What topics do the following E.I. Series of publications cover - E.I.7, 8, 18?

   1- 9   [illegible] - [illegible]   [illegible] 17

E.I.7 Provisions for Service Equipment in Single Domestic & Small Installations.

(i) Services equipment.
(ii) S.M.B. and Panel.
(iii) Socket metering.

E.I.8 Provisions for Service Equipment in Multiple Installations

(i) Services - OH/UG.
(ii) Fuses, Neutral link - layout, mounting, access cabeling.
(iii) Meters - layout, access, weather protection, cabeling, socket bases, sealing.

E.I.18 Metering which requires the Use of Current Transformers

(i) C.T.'s - location, layout, conductors, switchboard locations; (ii) Metering Equipment - protection, wiring.

8. Briefly describe how you would check "phase sequence" on a two phase and three phase meter to obtain the correct accuracy.

Two Phase - ~~Positive~~ CLOCKWISE Phase Sequence

Red Lead to left hand line terminal.
Yellow lead to right hand line terminal.
Blue lead to Neutral terminal terminal.

Three Phase - ~~Negative~~ ANTI-CLOCKWISE Phase Sequence

Red lead to left hand line terminal.
Yellow lead to centre line terminal.
Blue lead to right hand line terminal.

9. What size and how many pilot cables are required to be provided by the customer between the points of a pulsing meter and the summating meter?

Ans. 5 x 1.5mm^2 cables enclosed in conduit or a 5 x 1.5mm^2 core sheathed cable.

KNOWLEDGE OF COUNCIL'S METER TESTING PRACTICES & PROCEDURES

10. What metering errors occur when the meter neutral is not connected to the system neutral in:-

(a) Single phase meter, (b) 3 phase meter and (c) a number of single phase meters balanced over three phases?

Ans. (a) Meter disc will not rotate.
(b) & (c) For similar meters - meters will record at near accuracy because of an artificial star point being created, but an open circuited voltage coil or meter with different voltage coil will cause an out of balance and an inaccurate reading.

11. Why does the Council test meters at 0.5 lag P.F. when customers are not permitted generally, to have a P.F. below 0.8 lag?

12. If the phase sequence of a polyphase meter was found incorrect, what effect could this have on the accuracy of the meter?

13. Why must the secondary winding of a C.T. not be open circuited?

    Ans. (a) Induced high voltage across secondary terminals resulting in possible injury to the operator.

    (b) Damage to insulation and possible saturation of core.

14. Under what conditions can a polyphase meter be used to register single phase loads?

    Ans. All Voltage Coils must be energised.

KNOWLEDGE OF SAFE WORKING PRACTICES ASSOCIATED WITH METERING

15. What procedures are necessary whilst working on metering installations which are remote from the point of supply?

    Ans. Affix Danger notice or label at point of isolation - filled in by Technician - remove label at completion of job.

16. Explain the procedures for connecting/disconnecting consumer's mains.

    Ans. Neutral conductor is first to be connected and last disconnected up to 100A per phase - remove service fuse/s disconnect consumer's mains from service lines at P of A - insulate bare ends of service lines - reconnection check at P of A with test lamps and identify neutral.

17. What are the safety procedures to be adopted before work on an installation supplied directly from a substation?

    Ans. Access Permit to be taken up (read understand), check isolation - sign on and at conclusion sign off permit.

METER QUIZ. WEEK ONE.

I

I.Name the functions performed by the "GRID" in an A.C.Watthour Meter.

2.Define the following as applied to A.C W/hour meters in general.

(a)Direct connected! (b)Maximum Continuous Current!

(c)Watthour Constant! (d)Transformer operated!

3.What methods are available for calibrating a B.A.Z.IO/40 meter at

(a)Full load.(ie Basic Load)?

(b)Light load?

4.What other methods do you know of which are found for the adjustment of"full load" in various meters?

5.If a B.A.Z meter,400 revs/Kwh, has a load of 20 amps,U.P.F.applied to it,how many revolutions would take place in 70 seconds?

6.If the same current at 0.5 lag was applied to the above meter how many revolutions would take place in one minute?

7.In your own words,explain briefly what you consider are the main differences between a B.A.Z.meter and an "M" type meter!

8.Supply the missing words in the following:

(a)The purpose of the light load plate in a meter is............

.................................at light loads!

(b)The "overload" or "saturation" bridge allows a meter to be made accurate up to many times the basic current,and in fact a Meter of I5/IOO rating has a Maximum Continuous Current which is % basic load!

9.What governs the field strength of the current coil in a WF3 meter?

IO.Explain the electrical characteristic of (a)the potential coil, and (b)the current coil,in a single phase meter!

II.Define "creep", in a meter.

I2.What method is used to make a B.A.Z meter respond correctly to changes in power factor of the load being metered?

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All question papers are to be returned with your answer sheets!

QUESTIONS for L/H Snr TECH 1 INTERVIEWS.

Section.

1. General and Technical Education.

2. Experience in H.V. Metering.

3. Large Installations.

(a)What type of metering would you expect to find at the premises of an industrial customer with a connected load exceeding (say) 200 amps?

(b)Why do some installations have summation metering installed? (This question only if not brought out in the previous answers.).

(c) Where would you expect to find an E.M.F. register installed and what other equipment would be found at the same premises?

(d). Where summation metering is installed on a two service supply, using the CSS.783 form supplied explain what tests would be required if the customer had queried the accuracy of the account(hence the metering).

5. Ability to check C.T metering installation.

(a).What steps are required in checking a new low voltage C.T installation before the Accounts Branch can commence billing.Explain necessary forms.

(b).If an existing installation has had only a meter change, what steps are carried out ,if any, to ensure its' integrity?

(c) (If not forthcoming in the above) Explain the "Woodson Test" and how it may be carried out.

2.Explain the instrumentation required to be installed for a customer on H.V. T.O.U. tariff.(Elicit from this what knowledge of individual equipment is available).

3. GENERAL METERING.

(a).Explain the main differences you would see in a H.V and L.V. metering installation.

(b).What would be the effect of losing the metering neutral in a 3 phase whole current installation and how the neutral can be checked where needed.Under what circumstances is this test mandatory?

(c).What is the standard phase sequence in the S.C.C and the effect on metering accuracy of an incorrectly connected meter.If this meter was queried by the customer and was checked upon arrival and proven to be incorrect what action would the Technician take?.

(d).When requested (and paid for by the customer) what load monitoring facilities are normally provided? Explain the technical details.

(e)How can a rough check of the load being drawn by the customer be made without the use of instruments other than those installed at the premises?

QUIZ PAPER NUMBER 1.

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(1). You are to carry out the testing of a Landis & Gyr meter which revolves at 225 revolutions per kilowatthour. Calculate the figures for the following tests-

(a) 20 revolutions at 20A. U.P.F.
(b) " " " " 0.5 lag.
(c) 5 " " 1A. U.P.F.

Use the attached sheet and the information therein when making your calculations.

(2). Explain why a modern meter has a longer expected service life than could be anticipated from earlier types of meters.

(3). You are required to change both the voltage coil and the current coil in a B.A.Z 10/60 meter. Explain what special procedure you would carry out to help in ensuring that the meter could be recalibrated with a minimum of effort and also explain the safety steps you would carry out before energizing the meter for testing and calibration.

(4). Explain what steps are carried out in the Meter Test Room to ensure that no meter is sent into the field with an incorrect register fitted.

(5). What are the statutory requirements relating to meter accuracy which Council is required to adhere to?

(6). Explain why a system of remote controlled frequency injection for the purposes of Customer Load Control as used within this Council has advantages over a system which is restricted to the use of time switches only.

(7). Modern meters all have some form of overload and saturation bridge fitted in the magnetic circuit of the current section of the meter. What is the purpose of this device and in what way does it increase the reliability and accuracy of the meter?

(8). Define creep" as it applies to meter performance and explain what steps are taken to assist the prevention of creep in most single phase meters.

THIS QUIZ PAPER IS TO BE HANDED IN WITH YOUR ANSWER SHEETS!

Summation Metering

Q1. Explain the reason for using summated metering.

(A) Where supply is provided through more than one service originating from the same sub-station and a customer is being charged for a kW demand tariff some form of summation is required.

Q2(a) Explain how summation may be achieved and if any,
(b) the limitations of each.

A. (a) Arithmetical, impulse, thermal, by CTs
(b) Not appropriate in many cases to summate arithmetically for demand, Thermal is now obsolete. By CTs is only possible when CT have same ratio and length of each run is exactly equal.

Q3. Explain the sequence of instruments used and the function of each where EMF registers are used on a LV summated 3 service installations. ~~3 fact~~

(A) 3 pulsing meters (polyphase) into a summator which adds the pulses and give a pulsed output to the register which computes both energy and demand in the format required for the particular tariff for which the register has been programmed.

Q4. Some customers require a facility to monitor ~~either~~ load for either statistical or load control purposes and facilities to accomplish this are sometimes made available by Council. Explain what provisions are made and briefly the technicalities of the system.

Retransmission in the form of a pulsed barrier type relay which provides either a two wire or three wire system to which the customer can connect his own extra low voltage supply and get pulses for either or both demand and timing. If using three wire system value of pulse is half that with a two wire system.

Q5.

Explain what checks are necessary when carrying out "K" confirmation on a new CT installation and the other steps necessary for checking the integrity of the installation as a whole.

(ans) CT Ratio. Tong ammeter to load, ammeter in CT Secondary.
Visual on CT to check size & polarity (yellow dot towards source) and also check on secondary wiring. Polarity ~~Common~~ wire is plain ~~is marked with white tube~~, tapping is non polarity and has white tubing.
Check relationship of voltage & current in each element of meter. Check fuses are HRC 10 Amp.
Check that supply is available on all phases and that phase sequence is correct (ie anti clockwise)
Remove voltage fuses with load applied and check (if meters are single phase) that all meters stop. Insert fuses in turn (one only in at each check) ~~and observe~~ that the appropriate meter starts when the fuse is inserted and stops when removed. By suitable bridging of CTs / opening links / applying load combination check that the correct currents and voltages are associated with each other (It may be possible to use customers load to carry out this test.) If a meter reversal occurs the cause must be

ascertained. If not using customers load it ~~should~~ is not ~~be~~ possible to obtain this result unless incorrect connections are present. When customers load is being used and reversal of meter occurs it is possibly caused by ~~incorrect~~ the type of load (ie perhaps 415 volt welder) connected. This must be investigated if such is ~~detected~~ observed.

Q6 What is Council standard phase sequence for
(a) Three phase installation
(b) Two phase installation.

ANS. (a) Anti Clockwise (b) Clockwise

Q7 Explain how you would ascertain whether the above was in fact correct.

Ans 3 Ph. Connect Red lead to LH line terminal Yellow lead to centre line terminal & Blue lead to RH line terminal.
2 PH Connect Red lead to LH line terminal, Yellow lead to RH line terminal & Blue lead to neutral terminal.

Q8 Consider that the system neutral is not connected to the meter neutral in the following cases.
(a) Single phase meter
(b) Polyphase meter or 3 single phase meters
What would be the effect on the accuracy of the metering.

Ans (a) Meters will not rotate - hence no registration.
(b) Meters will be accurate whilst each voltage element remains intact (or each similar type meter in 3 x 1φ situation) but if an open circuit occurs in 1 element the star point

Safety.

Q1. When is equipment considered to be "alive".

Ans. Until proven to be dead by use of test lamps or other approved device.

Q2. What safety precautions must be taken when working on CT metering installation

ans Never open-circuit a CT always bridge use test lamps to check that no potential of any consequence exists above earth - either/both at CT end & meter test block end. Live busbars to be screened before using tong ammeter.

Q3 Define

Extra Low Voltage.	not above 32 VAC or 115VDC.
Low Voltage	exceeding 32VAC or 115V DC upto 650 Volts (AC or DC)
High	above 650V

Q4 Are safety shoes considered to provide protection against electric shock?

No.

Q5 What precautions are to be taken when using tong ammeters on exposed conductors.

an Use rubber gloves and/or rubber mats as well as screening of other conductors.

Q6. What precautions are to be taken when using megger.

All persons working on the mains and/or apparatus are to be warned of the test and assurance been received that they will stay clear.

will shift and large errors will occur. If one of the meters in a $3 \times 1\phi$ meters was changed for a different type of meter (ie voltage coil impedance different) then registation can be quite adversely affected.

Q9. Meters are generally tested at 20 amps U.P.F and 20 amps 0.5 lag. Council does not generally permit loads below 0.8 lag to be connected, how then are the above tests justifiable?

Ans Two points are tested which could be either UPF & 0.5 or UPF & 0. 0.5 is easily obtainable so this is used to prove the internal PF correction (ie relationship of voltage & current fluxes within the meter) is correct. If checked at any ~~reasonable~~ two figures the accuracy can be proven. 0 PF could be unreliable because (say) a mechanical problem may prevent the meter running. 0.5 is readily obtainable for test purposes.

Q10 What effect could an incorrect phase sequence have on the metering accuracy when a polyphase meter is used. What effect where 3 single phase meters are used.

an. Quite large metering errors (up to 10%) may occur - worse when power factor less than 1. No error with single phase meters

After completion of testing the circuits or equipment tested shall be discharged and earthed.